CALIFORNIA
APRIL 2014

Forest Health
2013 highlights

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Forest Resource Summary

From the Cleveland to the Klamath, California's 18 National Forests contain a treasure of wildlife, recreation, and much more. More than 600 of the 800 species of fish and wild animals, and over 4,000 of the 6,500 native plants in California reside in National Forests. These National Forests account for 25 percent of National Forest recreation visits nationwide and about half of the public wild land recreation in the state. National Parks and other federal, state, county and private lands provide the remainder.

Region 5 of the USDA Forest Service works cooperatively with federal and state partners to map, measure, monitor and assess the effects of biotic and abiotic agents on California's forests. Our forests are among the most complex and diverse in the nation, with 25 major forest types occurring across 32 million acres. Approximately 33% of California is forested and susceptible to a variety of forest pests, such as bark beetles and root disease depending on geographic location. Tree density, stand structure, air pollution, drought and other environmental factors contribute to tree decline.

Early leaf drop on blue oak in the Southern Sierra Nevada foothills. Photo by: Z. Heath

Map: Western Regional Climate Center, April 30, 2013. E. Luebehusen

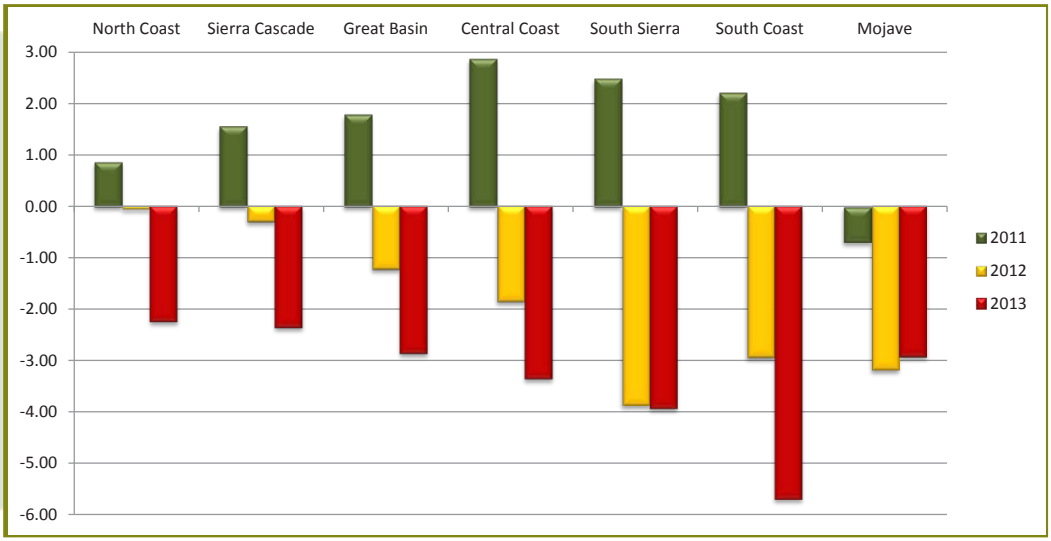
Environmental Conditions

In 2013, California received below-average pre (75% of average statewide) and decreased snow- of April 1 snowpack average statewide). These followed below average precipitation in 2012 thr of the state, as well as lower than average pre multiple years typically equates to increases in ba Even higher levels of beetle activity should be expected in 2014 as drought conditions have continued and intensified. Other symptoms of the drought included the desication and premature shedding of leaves in the summer by native oak species, and possibly the dramatic increase in gray pine mortality in the southern half of the State.

Gray pine mortality north of Pinnacles National Monument. Photo by: J. Moore

Palmer Drought Index

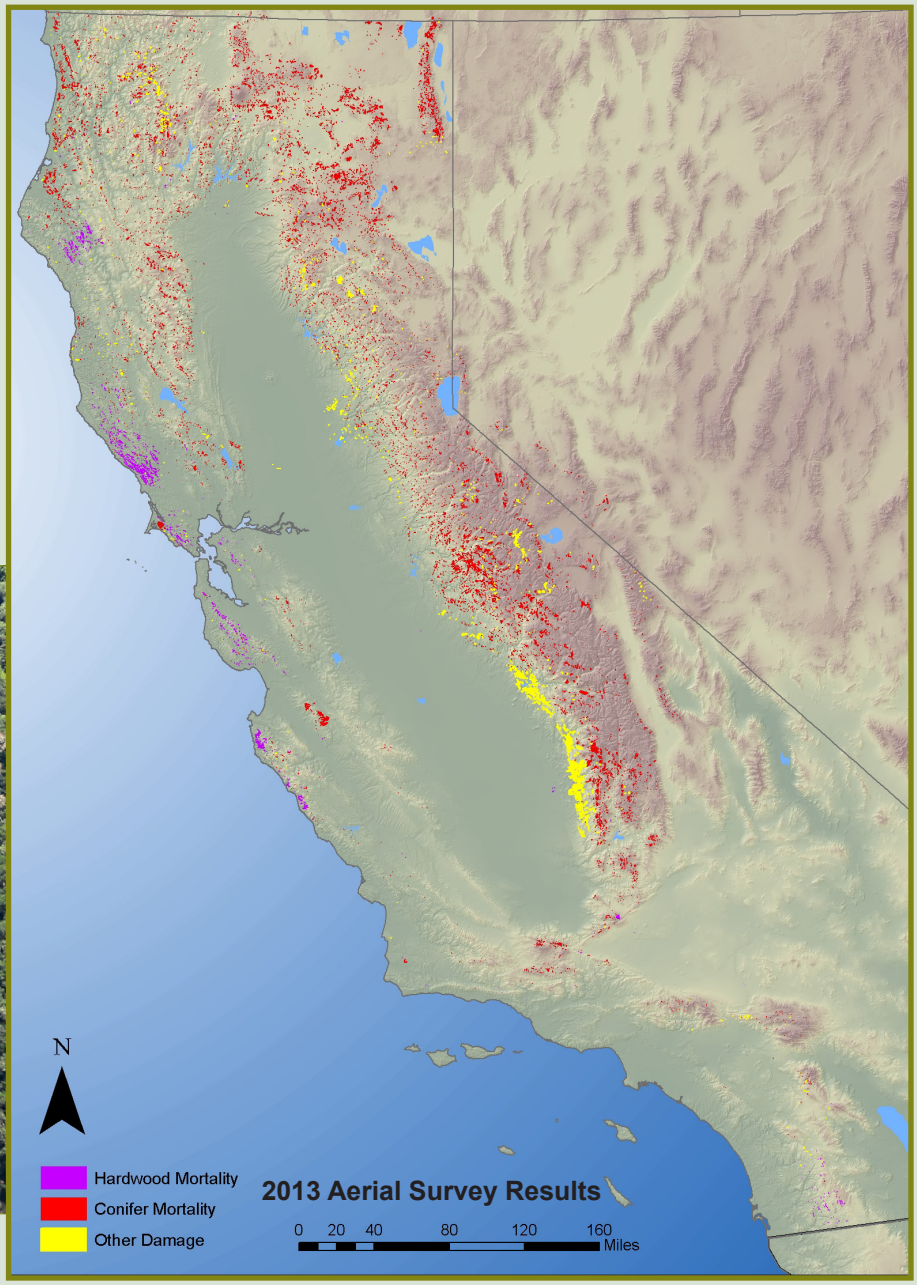
The Palmer Drought Index is an indicator of drought or moisture excess and ranges from -6 to +6, with negative values denoting degree of drought. In 2013, the yearly average Palmer Drought index values were negative across the State, ranging from -2.26 on the North Coast to -5.71 in the South Coast. The wettest zone was the North Coast and the driest was in the southern coastal area.



2013 Aerial Detection Survey

Aerial surveys are conducted annually to assess the health of California's forests. Surveyors fly in light, fixed-wing aircraft and use a digital sketch-mapping system to rapidly document tree mortality and damage across the State. In 2013, over 48 million acres were surveyed throughout California. Some level of tree mortality was detected on 483,000 acres, a slight decrease from 2012. However, increases in mortality were observed in areas such as the southern Sierra Nevada Range and in northeastern California. Elevated levels of mortality attributed to sudden oak death were detected throughout much of its distribution.

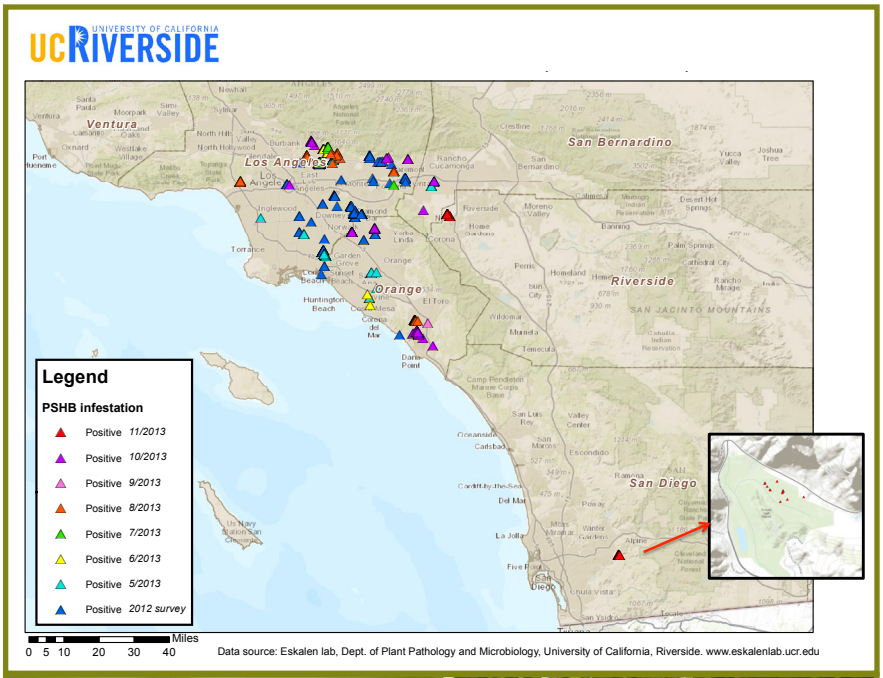
Coast live oak mortality caused by *P. ramorum* (sudden oak death) near Watsonville. Photo by: Z. Heath



Polyphagous Shot Hole Borer

In 2013, the polyphagous shot hole borer (PSHB, *Euwallacea* sp.) and *Fusarium* dieback (*Fusarium euwallaceae*) were found in California sycamore (*Platanus racemosa*), castorbean (*Ricinus communis*), red willow (*Salix laevigata*), and white alder (*Alnus rhombifolia*) for the first time on the Angeles NF. The ambrosia beetle attacks a wide range of diameter size classes (2 to 32 inches diameter at breast height). Ground surveys confirmed mortality of red willow and castorbean occurring at low levels.

This new invasive pest complex is caused by the fungus forming a symbiotic relationship with PSHB (morphologically indistinguishable from the tea shot hole borer, *Euwallacea fornicatus*), which is resulting in dieback and mortality of agricultural and landscape trees in the counties of Los Angeles, Orange and San Bernardino in southern California. When the beetle burrows into a tree, it inoculates it with the fungus, which attacks and plugs the tree's vascular tissue, blocking water and nutrients and eventually causing branch dieback. The fungus is the food source for the larvae.



Female beetle, *Euwallacea* sp. Photo by: A. Eskalen

Injury caused by polyphagous shot hole borer on white alder. Photo by: T. Coleman

California sycamore, box elder (*Acer negundo*), maple (*Acer* spp.), red willow, and castorbean are optimal trees to survey for signs of beetle presence as PSHB tends to infest these hosts first whenever present. Depending on the tree species, plant injury caused by PSHB can be identified either by staining, gumming, or a white-sugar exudate on the outer bark in association with a single beetle entry hole. At advanced infestation stages, there are often many entry/exit holes (approximately 0.033 in) in the tree. Female beetles are black and approximately 0.07-0.1 inches long; males are brown and about 0.05 inches long.

To date, PSHB has attacked more than 110 different tree species, but brood production has only been confirmed in 24 species, including box elder, California sycamore, castorbean, avocado (*Persea americana*), coast live oak (*Quercus agrifolia*), English oak (*Q. robur*), valley oak (*Q. lobata*), California sycamore (*Platanus racemosa*), big leaf maple (*Acer macrophyllum*), Japanese maple (*A. palmatum*), red willow, goldenrain (*Koelreuteria paniculata*), olive (*Olea europaea*), persimmon (*Diospyros* sp.), silk (*Albizia julibrissin*), American sweet gum (*Liquidambar styraciflua*), coral (*Erythrina corallodendon*), weeping willow (*Salix babylonica*), blue palo verde (*Parkinsonia florida*), palo verde (*Cercidium floridium*), tortuosa (*Salix matsudana*), and white alder.

Goldspotted oak borer

Goldspotted oak borer (GSOB) was detected for the first time in Riverside County, California, in late 2012. Twenty-nine infested California black oak trees have been subsequently found on private land within Riverside County. Prior to this discovery, the distribution of GSOB within California was restricted to San Diego County, California, where it continues to kill about two thousand coast live oak and black oak annually.

Goldspotted oak borer larvae in black oak in Idyllwild. Photo by: K. Corella

Ponderosa pine mortality near Lake Britton on the Hat Creek Ranger District.
Photo: D. Cluck

Whitebark pine mortality caused by mountain pine beetle continued in the Rock Creek Recreation Area, Inyo NF.
Photo: B. Bulaon

Western pine beetle galleries under the bark of ponderosa pine at Lovers Canyon, Klamath NF.
Photo: C. Snyder

Bark and Engraver Beetles

Acreage affected by bark beetles in California was reduced slightly from 2012 levels based on aerial survey data. Some localized areas had increases in activity, especially the west side of the southern Sierra Nevada Range, including the area affected by the Rim Fire of 2013, the largest recorded wildfire in the Sierra Nevada. Mountain pine beetle, western pine beetle, and fir engraver comprised the bulk of bark beetles causing tree mortality in California, however, Jeffrey pine beetle, Douglas-fir beetle, pine engraver beetle, pinyon Ips, California fivespined Ips, and red turpentine beetle were also reported as causing damage.

Mountain Pine Beetle

Pine mortality from mountain pine beetle (MPB) decreased slightly in 2013 according to aerial surveys. However, mortality of mature sugar pine continued, and was observed throughout the host range, especially in the southern Sierra Nevada. Large areas of current mortality of lodgepole and whitebark pine continued in some areas of northeastern California and the eastern side of the Sierra Nevada range.

Western Pine Beetle

Pine mortality from western pine beetle (WPB) decreased slightly in 2013 according to aerial surveys. Western pine beetle activity did increase in the Southern Sierra Nevada, especially around the area that burned in the Rim Fire. Elevated mortality of Coulter pine was also observed in southern California. In northern California, areas with blackstain root disease also had elevated mortality associated with WPB. Western pine beetle activity decreased in a few northeastern California locations possibly due to an extreme cold spell in January 2013. Dead western pine beetle larvae were observed within the bark of infested trees in cold air sink areas of Lassen National Forest.

Fir Engraver

Overall, fir mortality attributed to fir engraver decreased in 2013. This is the third year in a row of decline in fir mortality. A slight increase in fir mortality was noted in localized areas of northern California, and in the southern Sierra Nevada range, only scattered fir mortality was observed. Round-headed fir borer (*Tetropium abietis*) is part of the pest complex affecting fir in many areas.

Jeffrey Pine Beetle

More Jeffrey pine mortality was detected in aerial surveys in 2013 than in the last few years. In northwestern California, where Jeffrey pine beetle (JPB) is uncommon, Jeffrey pine beetle was found killing small pockets of Jeffery pine. In

Pine engravers and western pine beetle in a ponderosa pine plantation, Eldorado NF.
Photo: B. Bulaon

Cerambycid pupa in Jeffrey pine killed by Jeffrey pine beetle, Modoc NF.
Photo: D. Cluck

northeastern California, JPB appeared to be in decline based on ground surveys. In some areas, many dying Jeffrey pine were found to have high numbers of wood boring larvae, to the point where they may be limiting JPB brood success. Jeffrey pine in these areas were found to be attacked by ponderosa pine bark borer (*Acanthocinus princeps*), California flatheaded borer, (*Phaenops californica*), pine engraver (*Ips pini*) and emarginate ips (*I. emarginatus*), in addition to JPB. Only light JPB-related mortality was reported elsewhere in its range in California.

Douglas-Fir Beetle

Aerial surveys identified Douglas-fir beetle mortality in several pockets of large, mature Douglas-fir throughout northern California. The observed mortality had increased dramatically in size and distribution from 2012. Many large group kills (>30 trees) were observed in steep, north facing drainages where Douglas-fir grows in relatively pure stands. The current pattern of mortality resembles the previous Douglas-fir beetle outbreak, which occurred in the late 1970s.

Defoliators

Record high Douglas-fir tussock moth catches in 2012 were followed by light to moderate defoliation on the Plumas NF in 2013. Most of the defoliation was limited to branch tips and tree tops of white fir. However, at one location the Douglas-fir tussock moth feeding overlapped a previous white fir sawfly outbreak, resulting in complete defoliation of many trees. Scattered light defoliation of white fir in other locations in northern and central California was also observed.

Jeffrey pine beetle infested Jeffrey pines were cut and removed from Manzanita Lake Campground, Lassen Volcanic NP.
Photo: D. Cluck

Douglas-fir killed by Douglas-fir beetle, Plumas NF.
Photo: D. Cluck

Douglas-fir tussock moth defoliation of white fir.
Photo: B. Bulaon

Defoliated tops of white fir, Plumas NF.
Photo: D. Cluck

Sudden Oak Death (SOD)

Sudden oak death (*P. ramorum*) continues to be the primary cause of oak and tanoak mortality in coastal California. Tanoak mortality continued to be elevated, similar to last year's levels, probably due to increased spread of the pathogen from elevated rainfall several years ago. Areas with intense coast live oak mortality were observed in the San Francisco Bay Area. *Phytophthora ramorum* has been confirmed near the Six Rivers National Forest and Trinity County, California, which was previously uninfested.

In 2013, 136 waterway sites distributed throughout coastal California were monitored for *P. ramorum*, leading to the discovery of *P. ramorum* in multiple new watersheds in the northern extent of the disease. SOD Blitzes (a citizen science-based campaign in which community members gather symptomatic bay leaves for laboratory diagnosis) were undertaken again in 2013. Results from the 2013 Blitzes also identified new areas of infection, primarily in the San Francisco Bay area.

The Redwood Valley eradication effort, at the northernmost extent of SOD in California, shifted from direct control to a strategy of conservation management, with a goal of tanoak retention at low levels and slowed pathogen spread. Six stakeholder entities and dozens of private landowners are involved. Roughly 800 acres have recieved a treatment of some type in this area. Management efforts in infected areas of other parts of California are primarily for fuel reduction following tree mortality events.

White Pine Blister Rust

Throughout the Sierra Nevada range, white pine blister rust (WPBR) continued to affect sugar pines and other five needle pines. The incidence of rust infection on the leaves of the alternate host (*Ribes* spp.) was greater that it has been in several years, suggesting possible disease spread or intensification in the near future.

Oak and tanoak mortality associated with sudden oak death, detected via aerial survey during 2013.
Map: Z. Heath

Native Diseases

Heterobasidion and black stain root diseases occur throughout much of California and were reported in multiple locations across the state in 2013.

Black stain root disease in dying ponderosa pine at the Mud Flow Research Natural Area, Shasta-Trinity NF. Photo: P. Angwin

Gray pine dieback over landscape.
Photo: K. Corella

Gray pine infested with Heterobasidion root rot.
Photo: K. Corella

Screen shot from calweedmapper.calflora.org.

California is home to thousands of native plant species and is recognized internationally as a “biodiversity hotspot”. Approximately 1,800 non-native plants also grow in the State, several of which are considered troublesome in forested areas. No new species of invasive plants were reported in 2012.

The California Invasive Plant Council, (Cal-IPC) provides information to help land managers deal more effectively with invasive plants. In 2012, Cal-IPC focused on two major efforts: 1) mapping and risk assessment, and 2) prevention. Mapping efforts included the compilation of invasive plant distribution data for 204 invasive species and then integrated these data with climate change models to predict distributions of 79 invasive species for 2050. These data are available through the CalWeedMapper system (calweedmapper.calflora.org). Prevention efforts included the publication of two Best Management Practices manuals on preventing the spread of invasive plants.

Local eradication and control efforts were ongoing for several invasive plants, including several species of thistle, knapweed, tamarisk, perennial pepperweed, tree of heaven, arundo, Himalaya blackberry, and gorse.

Artichoke thistle (*Cynara cardunculus*). The Agricultural Commissioner’s office in Santa Barbara Co. is working to control artichoke thistle where it threatens to spread onto USDA Forest Service lands. Photo: Wikipedia Commons

Goatsrue (*Galega officinalis*). This federal noxious weed is currently found in two California watersheds - one in Mendocino Co. (about 100 plants), and another larger population in Lake Co. (thousands of plants). Photo: Wikipedia Commons

Contacts and Additional Information

If you have questions about forest insect and disease activity in California, please contact personnel in one of these regional or field offices:

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